ENVIRONMENTAL MONITORING

Routine Monitoring Program

Routine activities at the West Valley Demonstration Project (WVDP) can result in the release of radioactive or hazardous substances that could affect the environment. Possible pathways for the movement of radionuclides or hazardous substances from the WVDP to the public include milk and food consumed by humans; forage consumed by animals; sediments, soils, groundwater, and surface water; and effluent air and liquids released by the WVDP.

The food pathway is monitored by collecting samples of beef, hay, milk, and produce at near-site and remote locations, samples of fish upstream and downstream of the site, and venison samples from near-site deer and from background locations. Stream sediments are sampled upstream and downstream of the WVDP, and both on-site groundwater and off-site drinking water are routinely sampled. Direct radiation is monitored on-site, at the perimeter of the site, in communities near the site, and at background locations.

The primary focus of the monitoring program, however, is on surface water and air pathways, as these are the primary means of transport of radionuclides from the WVDP.

Liquid and air effluents are monitored on-site by collecting samples at locations where radioactivity or other regulated substances are released or might be released. Release points include water effluent outfalls and plant ventilation stacks.

Surface water samples are collected within the Project site from ponds, swamps, seeps, and drainage channels that flow through the Western New York Nuclear Service Center (WNYNSC) and thence off-site into Cattaraugus Creek.

Both surface water and air samples are collected at site perimeter locations where the highest off-site concentrations of transported radionuclides might be expected. Samples are also collected at remote locations to provide background concentration data for comparison with data from on-site and near-site samples.

Sampling Program Overview

The complete environmental monitoring schedule is located in Appendix B. This schedule provides information on monitoring and reporting requirements and the types and extent of sampling and monitoring at each location. An explanation of the codes that identify the sample medium and the specific sampling or monitoring location is also found in Appendix B (p.B-iii). For example, a sample location code such as AFGRVAL indicates an air sample (A), off-site (F), at the Great Valley (GRVAL) sampling station. These codes are used throughout this report for ease of reference and to be consistent with the data reported in the appendices.

Water Sampling Locations. Automatic samplers collect surface water at points along drainage channels within the WNYNSC that are most likely to show any radioactivity released from the site. These automatic samplers collect a 50-milliliter (mL) aliquot (about one-quarter of a cup of water) every half-hour. The aliquots are pumped into a large container from which samples are collected. The samplers operate on-site at four locations: WNSP006, the point in Frank's Creek where Project drainage leaves the security-fenced area; WNNDADR, the drainage point downstream of the Nuclear Regulatory Commission (NRC)-licensed disposal area (NDA); WNSWAMP, the northeast swamp drainage; and WNSW74A, the north swamp drainage.

Off-site, automatic samplers collect surface waters from Buttermilk Creek at a background station upstream of the site (WFBCBKG), from Buttermilk Creek downstream of the site at Thomas Corners Road bridge (WFBCTCB), and from Cattaraugus Creek at Felton Bridge (WFFELBR).

Grab samples are collected at several other surface water locations both on-site and off-site, including a background location on Cattaraugus Creek at Bigelow Bridge (WFBIGBR).

Figure A-2 (p.A-4 in Appendix A) shows the locations of the on-site surface water monitoring points. Figure A-3 (p.A-5) shows the locations of the off-site surface water monitoring points.

Air Sampling Locations. Air samplers are located on-site, at the perimeter of the site, and at points remote from the WVDP. Figure A-4 (p.A-6) shows the locations of the on-site air effluent monitors and samplers and the on-site ambient air samplers; Figure A-5 (p.A-7) and Figure A-12 (p.A-14 in Appendix A) show the locations of the perimeter and remote air samplers.

Radiological Monitoring: Surface Water

The WVDP site is drained by several small streams. (See Figs.A-2 [p.A-4] and A-3 [p.A-5].) Frank's Creek flows along — and receives drainage from — the south plateau. As Frank's Creek flows northward, it is joined by a tributary, Erdman Brook, which receives run-off from the low-level waste treatment facility. On the north plateau, beyond the Project fence line, the north and northeast swamp areas and Quarry Creek drain into Frank's Creek.

Frank's Creek continues past the WVDP perimeter and flows across the WNYNSC, where it enters Buttermilk Creek. Radionuclide concentrations in Buttermilk Creek are monitored upstream and downstream of the WVDP. Further downstream, Buttermilk Creek leaves the WNYNSC and enters Cattaraugus Creek, which is also monitored for radionuclide concentrations both upstream and downstream of the point where the creek receives effluents from the WVDP.

Two liquid effluents, from the low-level waste treatment facility and from the northeast and north swamp drainage, contribute to site dose estimates. (See Chapter 4, Radiological Dose Assessment, Table 4-2 [p.4-7] for an estimate of the dose attributable to these waterborne effluents.)

Low-level Waste Treatment Facility Sampling Location. The largest single source of radioactivity released to surface waters from the Project is the discharge from the low-level waste treatment facility through the lagoon 3 weir

(WNSP001 on Fig.A-2 [p.A-4]) into Erdman Brook, a tributary of Frank's Creek. There were four batch releases totaling about 29.1 million liters (7.67 million gal) in 1999. Composite samples were collected near the beginning and end of each discharge and one effluent grab sample was collected during each day of discharge. Samples were analyzed for gross alpha and gross beta radioactivity, for gamma-emitting radionuclides, and for specific radionuclides as noted in Appendix B, p.B-7.

The total amounts of radioactivity from specific radionuclides in the lagoon 3 effluent are listed in Appendix C, Table C-1 (p.C-3). The annual average concentration of each radionuclide is divided by its corresponding Department of Energy (DOE) derived concentration guide (DCG) in order to determine what percentage of the DCG was released. (DOE standards and DCGs for radionuclides of interest at the WVDP are found in Appendix K [Table K-1, p.K-3].) As a DOE policy, the sum of the percentages calculated for all radionuclides released should not exceed 100%.

The combined annual average of radionuclide concentrations from the lagoon 3 effluent discharge weir in 1999 was approximately 31.5% of the DCGs. (See Table C-2 [p.C-4]). This is comparable to the average concentration over the last five years of approximately 33%.

In 1998 the low-level waste treatment facility water-processing equipment (LLWTF) was replaced by a new facility and equipment (LLW2). Both the LLWTF and the LLW2 were designed to efficiently remove strontium-90 and cesium-137, the more prevalent of the long-lived fission products in WVDP wastewaters.

Other radionuclides are also removed to a lesser extent by the low-level waste treatment facility. For example, one other major contributor to the total combined DCG in lagoon 3 effluent is uranium-232, which averaged about 10% of its DCG in 1999. Uranium-232 and other uranium isotopes are found in WVDP liquid waste because they were present in the nuclear fuel that was once reprocessed at the site. Variations in liquid effluent radionuclide ratios continue to reflect the dynamic nature of the waste streams being processed through the low-level waste treatment facility.

(Outfall WNSP001 also is monitored for nonradiological parameters under the New York State Pollutant Discharge Elimination System [SPDES] program. See Nonradiological Monitoring: Surface Water [p.2-25].)

Northeast Swamp and North Swamp Sampling Locations. The northeast and north swamp drainages on the site's north plateau conduct surface water and emergent groundwater off-site.

The northeast swamp sampling point (WNSWAMP) monitors surface water drainage from the site's north plateau. The north swamp sampling point (WNSW74A) monitors drainage to Quarry Creek from the northern end of the Project premises. (See Fig.A-2 [p.A-4].) Waters from the northeast swamp drainage run into Frank's Creek downstream of location WNSP006. (See Other Surface Water Sampling Locations [p.2-4].)

Samples from WNSWAMP and WNSW74A are collected weekly and analyzed for radiological parameters. Other than gross beta and strontium-90, concentrations of all radiological parameters detected at WNSWAMP and WNSW74A were less than 1% of the applicable DCGs. The maximum and minimum gross alpha and gross beta results from WNSWAMP and WNSW74A are noted on Tables 2-1 and 2-2 (p.2-5). Complete data from these two locations are found in Tables C-7 and C-8 (pp.C-9 and C-10 in Appendix C).

An upward trend in gross beta concentrations at WNSWAMP, first noted in 1993, continued into 1999, when it leveled off. Gross beta activity at this location is largely attributable to strontium-90. (See Special Groundwater Monitoring, p.3-15.)

Strontium-90 concentrations at WNSWAMP in 1999 ranged from a low of 6.07E-07 μCi/mL to a high of 3.22E-06 μCi/mL (22.4 Bq/L to 119 Bq/L), with an annual average of 1.83E-06 μCi/mL (67.8 Bq/L). This average is 183% of the DCG for strontium-90, 1E-06 μCi/mL (37 Bq/L). (See Chapter 3, Fig.3-4, p.3-16, for a graph of the annualized average strontium-90 concentration at WNSWAMP in 1999.) Even though waters exceeding the strontium-90 DCG drain from WNSWAMP into Frank's Creek, waters collected from Cattaraugus Creek downstream at the first point of public access (WFFELBR) averaged less than 1% of the DCG. (See Off-site Surface Water Sampling, p.2-9.)

Other Surface Water Sampling Locations. Samples from the sanitary and industrial wastewater treatment facility discharge (WNSP007), from subsurface drainage from the perimeter of the low-level waste treatment facility storage lagoons (WNSP008), and from a point in Frank's Creek (WNSP006, where discharges from WNSP001, WNSP007, and WNSP008 leave the site) are routinely monitored for radiological parameters. (See Fig.A-2 [p.A-4].) Radiological results of analyses from WNSP006, WNSP007, and WNSP008 are summarized in Tables C-4, C-5, and C-6 (pp.C-6 through C-8). Samples from these points also are monitored for nonradiological parameters as part of the site's SPDES program. (See Nonradiological Monitoring: Surface Water [p.2-25].)

WNSP006 is located more than 4.0 kilometers (2.5 mi) upstream from Thomas Corners Road, the last monitoring point before Buttermilk Creek leaves the WNYNSC. Samples from WNSP006 are retrieved weekly and composited both monthly and quarterly and are analyzed for the same radionuclides as the effluent samples from WNSP001. The highest monthly concentration of a beta-emitting radionuclide at WNSP006 was strontium-90 at 3.31E-08 μCi/mL (1.22 Bq/L), which corresponds to 3.3% of the DCG for strontium-90. Average concentrations of gross alpha (as americium-241), gross beta (as strontium-90), strontium-90, cesium-137, and tritium were each less than 5% of the comparable DCG, as were 1999 averages for the radiological parameters monitored at WNSP007 and WNSP008.

The average gross alpha and gross beta data from location WNSP006 and the maximum and minimum results are noted in Tables 2-1 and 2-2 (*facing page*) for comparison with results from other on- and off-site surface water locations.

The thirteen-year trends of gross alpha, gross beta, and tritium concentrations at location WNSP006 are shown on Figure 2-1 (p.2-6). The long-term trend plot for WNSP006 shows fluctuations that reflect variable concentrations in treated WVDP liquid effluent being released from the site. Concentrations observed farther downstream at the Felton Bridge sampling location, the first point of public access to surface waters leaving the WVDP site, continue to be close to or indistinguishable from background.

Sampling point WNSP005, which monitors drainage from land on the east side of the main plant, and WNCOOLW, which monitors facility coolant water, are sampled monthly for gross alpha, gross beta, and tritium concentrations. WNCOOLW also is sampled quarterly for gamma isotopes. Radiological data for WNSP005 and WNCOOLW are found in Tables C-3 and C-11 (pp.C-5 and C-13).

Average gross alpha and tritium concentrations for both locations were below detection levels in 1999. Average gross beta concentrations at WNSP005 and WNCOOLW were considerably

Table 2-1
1999 Gross Alpha Concentrations at Surface Water Sampling Locations

Location	No. of Samples	Range		Annual Average	
Off-site		*(µCi/mL)*	*(Bq/L)*	*(µCi/mL)*	*(Bq/L)*
WFBCBKG	12	<3.84E-10 — 3.58E-09	<1.42E-02 — 1.32E-01	7.77±8.23E-10	2.88±3.05E-02
WFBCTCB	12	<5.21E-10 — 1.90E-09	<1.93E-02 — 7.03E-02	8.62±8.36E-10	3.19±3.09E-02
WFBIGBR	12	<4.22E-10 — 1.59E-09	<1.56E-02 — 5.89E-02	3.18±8.57E-10	1.17±3.17E-02
WFFELBR	12	7.85E-10 — 6.01E-09	2.90E-02 — 2.22E-01	2.29±1.52E-09	8.49±5.61E-02
On-site					
WNNDADR	12	<9.51E-10 — 2.65E-09	<3.52E-02 — 9.81E-02	0.72±1.35E-09	2.68±4.98E-02
WNSP006	53	<5.72E-10 — 4.74E-09	<2.12E-02 — 1.75E-01	0.62±1.55E-09	2.30±5.73E-02
WNSW74A	53	<7.64E-10 — 3.60E-09	<2.83E-02 — 1.33E-01	-0.12±1.99E-09	-0.43±7.37E-02
WNSWAMP	53	<5.74E-10 — 2.85E-09	<2.12E-02 — 1.06E-01	-0.11±1.69E-09	-0.43±6.27E-02

Table 2-2
1999 Gross Beta Concentrations at Surface Water Sampling Locations

Location	No. of Samples	Range		Annual Average	
Off-site		*(µCi/mL)*	*(Bq/L)*	*(µCi/mL)*	*(Bq/L)*
WFBCBKG	12	1.72E-09 — 8.27E-09	6.38E-02 — 3.06E-01	3.67±1.34E-09	1.36±0.50E-01
WFBCTCB	12	5.24E-09 — 1.52E-08	1.94E-01 — 5.64E-01	8.70±1.59E-09	3.22±0.59E-01
WFBIGBR	12	1.46E-09 — 4.00E-09	5.38E-02 — 1.48E-01	2.70±1.24E-09	9.99±4.60E-02
WFFELBR	12	1.80E-09 — 1.47E-08	6.65E-02 — 5.45E-01	5.86±1.94E-09	2.17±0.72E-01
On-site					
WNNDADR	12	1.21E-07 — 1.88E-07	4.47E+00 — 6.95E+00	1.47±0.05E-07	5.44±0.20E+00
WNSP006	53	1.21E-08 — 1.73E-07	4.47E-01 — 6.39E+00	4.65±0.43E-08	1.72±0.16E+00
WNSW74A	53	3.93E-09 — 4.24E-08	1.45E-01 — 1.57E+00	1.09±0.38E-08	4.02±1.40E-01
WNSWAMP	53	5.49E-07 — 6.64E-06	2.03E+01 — 2.46E+02	3.71±0.03E-06	1.37±0.01E+02

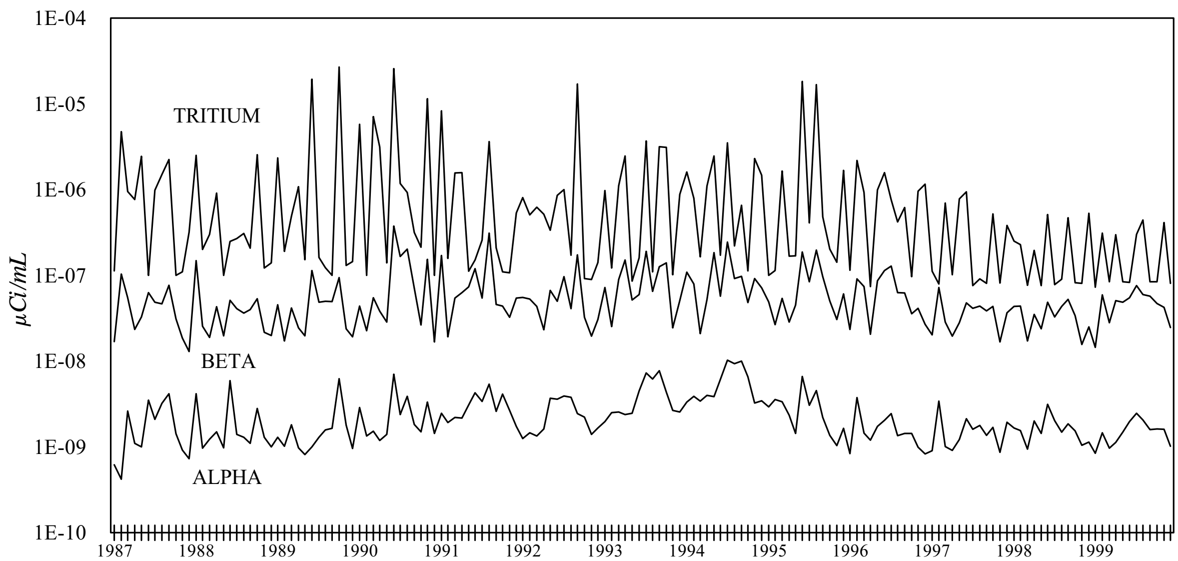


Figure 2-1. Thirteen-year Trends of Gross Alpha, Gross Beta, and Tritium Concentrations at Sampling Location WNSP006

lower than the strontium-90 DCG (<14% and <1% respectively). Average cesium concentrations at WNCOOLW were below detection levels in 1999.

Another sampling point, WN8D1DR, is at a storm sewer manhole access that originally collected surface and shallow groundwater flow from the high-level waste tank farm area. (Notable increases in gross beta and tritium activity at this location, attributable to historical site contamination, were described in previous annual site environmental reports.) In July 1993 the access was valved off from the original high-level waste tank farm drainage area to prevent collected waters from rising freely to the surface. Although samples from this location are not thought to be representative of either local groundwater or surface water, weekly sampling for gross alpha, gross beta, and tritium continues at this point. A monthly composite is analyzed for gamma radionuclides and strontium-90.

Average gross alpha, cesium-137, and tritium concentrations from WN8D1DR were all below detection levels in 1999. Gross beta concentrations, attributable largely to strontium-90, were less than 2% of the applicable DCG. Radiological data for WN8D1DR are found in Table C-13 (p.C-15).

SDA and NDA Sampling Locations. Two inactive underground disposal areas, the Nuclear Regulatory Commission (NRC)-licensed disposal area (NDA) and the state-licensed disposal area (SDA), lie on the south plateau of the site. (The SDA is managed by the New York State Energy and Research Development Authority [NYSERDA].) The drum cell, an aboveground structure used to store approximately 19,000 drums of processed low-level radioactive waste, is located nearby. Surface waters, which flow from the south to the north, are routinely monitored at several points around these sites. (See Fig.A-2 [p.A-4].)

New York State-licensed Disposal Area (SDA). Immediately south of the SDA, sampling point WNDCELD monitors surface drainage from the area of the drum cell. Point WNSDADR monitors drainage from trench covers on the southwestern area of the SDA. To the northeast, sampling point WNFRC67, in Frank's Creek, is used to monitor drainage downstream of the drum cell and the eastern and southern borders of the SDA. Results from WNDCELD are in Table C-14 (p.C-16), from WNSDADR in Table C-12 (p.C-14), and from WNFRC67 in Table C-9 (p.C-11).

Averages for most radiological parameters at these points were below analytical detection levels in 1999. Although monthly gross alpha, gross beta, and tritium concentrations increased in late summer and early fall, comparison of the 1999 data sets with the 1999 background data sets (WFBCBKG) showed no statistically significant differences. The highest beta concentration, 2E-08 μCi/mL at WNSDADR, was 2% of the most restrictive beta DCG.

NRC-licensed Disposal Area (NDA). Sampling point WNNDATR is a sump at the bottom of a steep-sided trench immediately downgradient of the NDA that intercepts groundwater from the NDA. If radiological or nonradiological contamination were to migrate through the NDA, it would most likely be first detected in samples from WNNDATR. Monthly samples from WNNDATR are taken under the auspices of the environmental monitoring program, and quarterly samples under the auspices of the groundwater monitoring program.

Surface water drainage downstream of the NDA is monitored at WNNDADR; sampling point WNERB53 in Erdman Brook monitors surface waters further downstream from the NDA before they join with drainage from the main plant and lagoon areas. Results from WNNDATR are in Table C-20 (p.C-22), from WNNDADR in Table C-19 (p.C-21), and from WNERB53 in Table C-10 (p.C-12). Gross alpha and gross beta results from WNNDADR are included in Tables 2-1 and 2-2 (p.2-5) for comparison with results from other surface water locations.

In addition to the routine samples collected by the WVDP, samples are collected and analyzed by the New York State Department of Health (NYSDOH) at the two stream sampling points that receive drainage from the south plateau, WNFRC67 and WNERB53.

Gross alpha results at WNNDATR, WNNDADR, and WNERB53 were indistinguishable from background (WFBCBKG). Although gross beta results at these three locations were elevated with respect to background, average concentrations were well below applicable DCGs in 1999:

- Gross beta concentrations at WNNDATR averaged 1.22E-07μCi/mL (4.5 Bq/L), which is just under 13% of the DCG for strontium-90 in water (1E-06 μCi/mL).

- Gross beta concentrations at WNNDADR averaged 1.47E-07μCi/mL (5.4 Bq/L). Assuming that the gross beta concentration originates entirely from strontium-90, this average is close to 15% of the DCG for strontium-90. (The actual average strontium-90 concentration — 6.98E-08 μCi/mL [2.6 Bq/L] — was about 7% of the DCG.) Gross beta concentrations were higher downstream of the NDA at WNNDADR than in waters from the interceptor trench, WNNDATR. However, gross beta concentrations at WNNDADR appear to be steady or declining. (See Fig. 2-2, p.2-8.) Residual contamination from past waste burial activities in soils outside the NDA is the likely source of gross beta activity in samples from WNNDADR.

- Gross beta concentrations at WNERB53 averaged 1.95E-08 μCi/mL (0.72 Bq/L). This is less than 2% of the DCG for strontium-90.

- Although average tritium concentrations at both WNNDATR and WNNDADR were elevated with respect to background concentra-

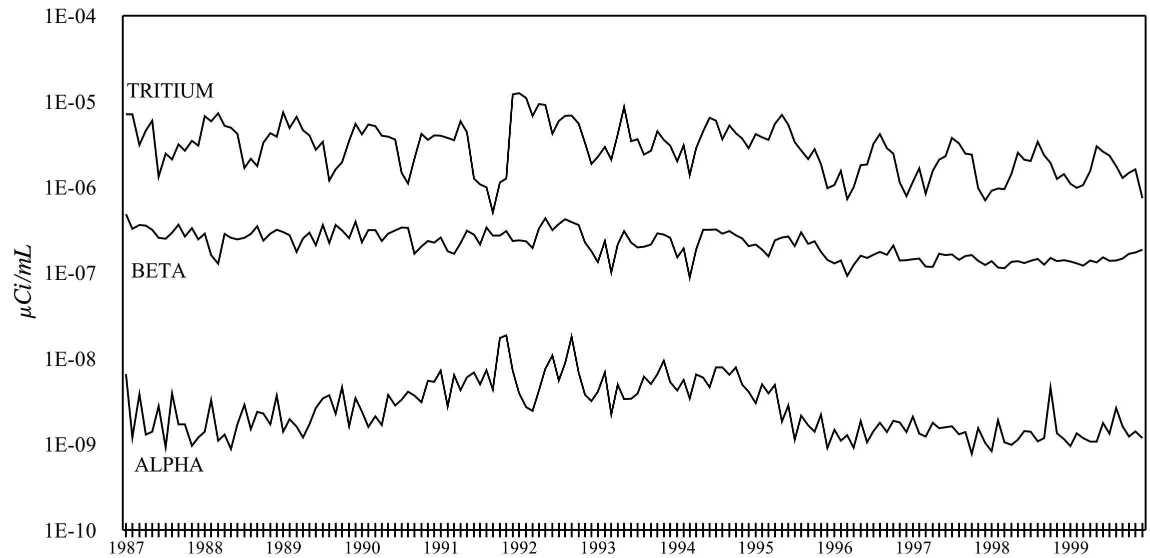


Figure 2-2. Thirteen-year Trends of Gross Alpha, Gross Beta, and Tritium Concentrations at Sampling Location WNNDADR

tions (WFBCBKG), these were less than 1% of the DCG for tritium in water (2E-03 μCi/mL). The average tritium concentration at WNNDATR was 7.12E-06 μCi/mL (263 Bq/L), and at WNNDADR it was 1.61E-06 μCi/mL (60 Bq/L). Allowing for seasonal variations, the overall trends of tritium concentrations at WNNDADR and WNNDATR have shown a slight decrease over time. (See Fig.2-2 above.) Since the half-life of tritium is slightly longer than twelve years, decreasing tritium concentrations may be partially attributed to radioactive decay. Tritium concentrations at WNERB53 were indistinguishable from background.

• A key indicator of possible migration of non-radiological organic contaminants from the NDA would be iodine-129, which is known to travel with the organic contaminants present in the NDA and is soluble in water. Although iodine-129 has been detected upon occasion at WNNDADR and WNNDATR in previous years, in 1999 all iodine-129 concentrations at these locations were below the analytical detection limit of 2E-09 μCi/mL.

• Average cesium-137 results as measured at WNNDADR and WNNDATR were below detection levels in 1999.

• Average total organic halides (TOX) concentrations from both WNNDATR and WNNDADR were lower in 1999 than in 1998. TOX measurements are used to detect the presence of certain organic compounds.

Standing Pond Water Sampling Locations. In addition to samples from moving water (streams or seeps), samples from ponds within the retained premises (WNYNSC) are also collected and tested annually for various radiological and water quality parameters in order to confirm that no major changes are occurring in standing water within the Project environs.

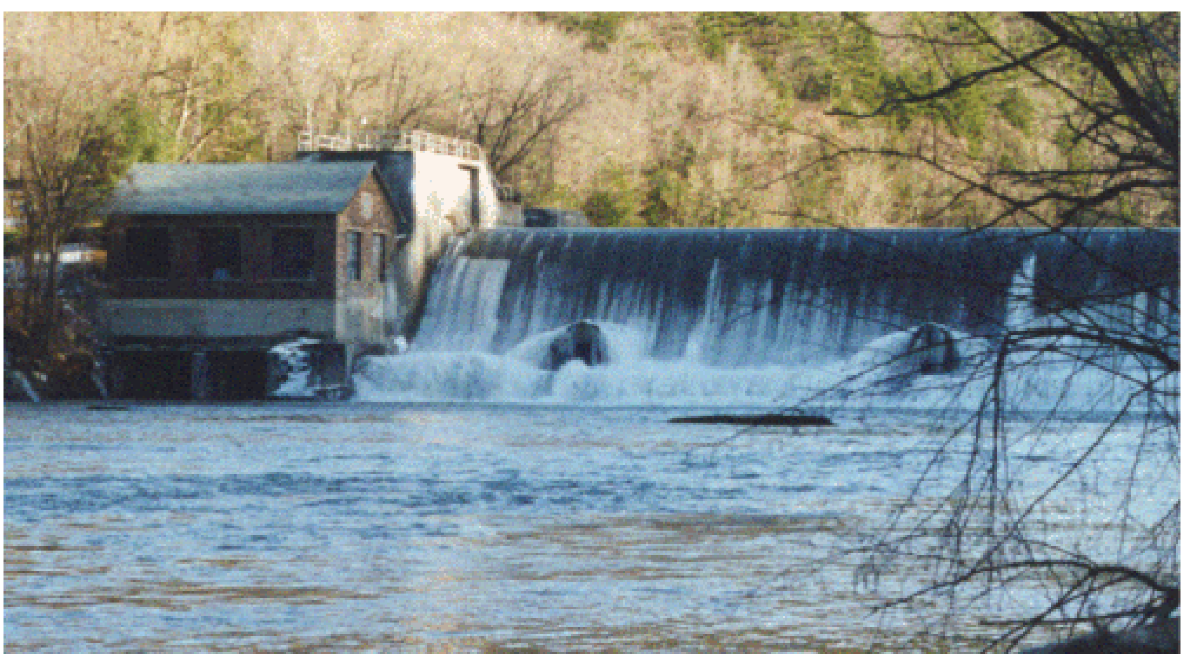
Four ponds near the site were tested in 1999. For comparison, a background pond 14.1 kilometers (8.8 mi) north of the Project was also tested. (See Figs.A-2 and A-3 [pp.A-4 and A-5] for the locations of the five ponds and Table C-21 [p.C-23] for a summary of sampling results.) Gross beta concentrations at all but one pond on the north plateau, WNSTAW6, were statistically indistinguishable from background concentrations, and the gross beta concentration at WNSTAW6, although elevated, was less than 1% of the DCG for strontium-90 in water. Gross alpha and tritium concentrations in samples from all on-site ponds were statistically the same as concentrations at the background pond.

Off-site Surface Water Sampling Locations. Samples of surface water are collected at four off-site locations, two on Buttermilk Creek and two on Cattaraugus Creek. Off-site surface water and sediment sampling locations are shown on Fig.A-3 (p.A-5). Tables 2-1 and 2-2 (p.2-5) list the ranges and annual averages for gross alpha and gross beta activity at off-site surface water locations, which may be compared to data from on-site locations.

Fox Valley Road and Thomas Corners Bridge Sampling Locations. Buttermilk Creek is the major surface drainage from the WNYNSC. Two surface water monitoring stations are located on Buttermilk Creek, one upstream of the WVDP at Fox Valley Road (WFBCBKG) and one downstream of the WVDP at Thomas Corners bridge (WFBCTCB) that is also upstream of Buttermilk Creek's confluence with Cattaraugus Creek. The Thomas Corners bridge sampling location represents an important link in the pathway to humans because dairy cattle have access to the water here.

Samples collected every week are composited monthly and analyzed for tritium, gross alpha, and gross beta radioactivity. A quarterly composite is analyzed for gamma-emitting radionuclides and strontium-90. Quarterly samples from WFBCBKG, the background location, also are analyzed for specific radionuclides as noted in Appendix B, p.B-29, and the results are used as a base for comparison with results of samples from site effluents.

Table C-22 (p.C-24) lists radionuclide concentrations at the Fox Valley Road background location; Table C-23 (p.C-25) lists radionuclide



Springville Dam on Cattaraugus Creek

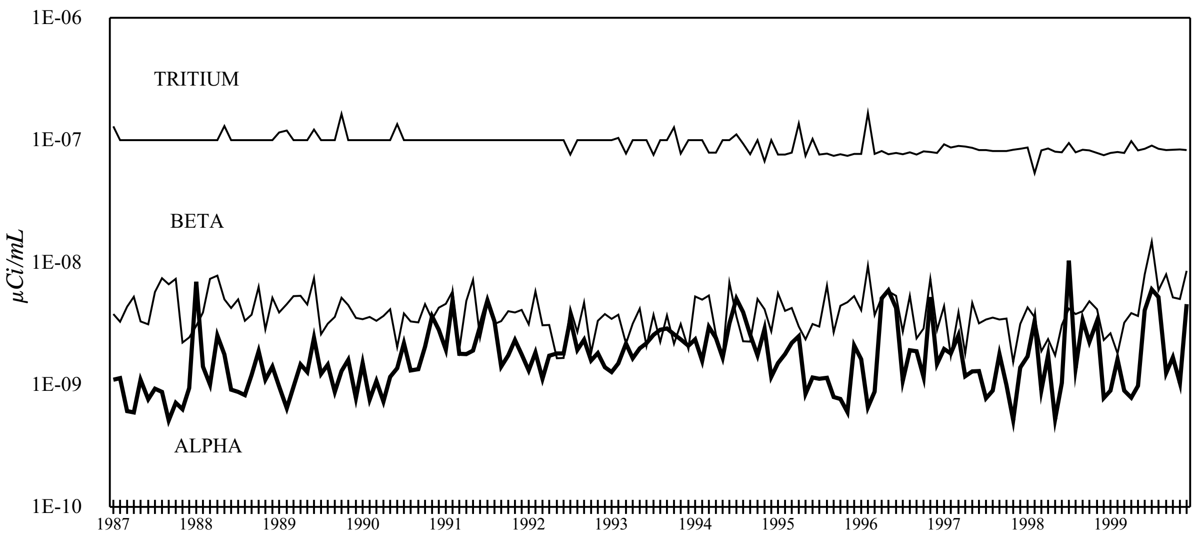


Figure 2-3. Thirteen-year Trends of Gross Alpha, Gross Beta, and Tritium Concentrations at Sampling Location WFFELBR

concentrations downstream of the site at Thomas Corners bridge. Gross alpha, tritium, and cesium-137 concentrations at Thomas Corners bridge were statistically the same as background concentrations in 1999. The 1999 average gross beta concentration at Thomas Corners bridge was slightly higher than the concentration upstream of the site. This may be attributed to small amounts of radioactivity from the site entering Buttermilk Creek via Frank's Creek. However, even if the largest gross beta concentration (1.52E-08 μCi/mL [0.56 Bq/L]) were attributable entirely to strontium-90, it would represent less than 2% of the DCG.

Cattaraugus Creek at Felton Bridge and Bigelow Bridge Sampling Locations. Buttermilk Creek flows through the WNYNSC and then off-site, where it flows into Cattaraugus Creek. An automated sampler is located on Cattaraugus Creek at Felton Bridge (WFFELBR), just downstream of the point where Buttermilk Creek enters. Samples are collected weekly and analyzed for gross alpha, gross beta, and tritium concentrations. A chart recorder registers the stream depth during the sampling period so that a flow-weighted weekly sample can be proportioned into a monthly composite, which is analyzed for gross alpha, gross beta, tritium, strontium-90, and gamma-emitting radionuclides. (See Table C-24 [p.C-26].)

Background samples are collected monthly from Cattaraugus Creek at Bigelow Bridge (WFBIGBR), which is upstream of the point where Buttermilk Creek enters. These samples are analyzed for concentrations of gross alpha, gross beta, tritium, strontium-90, and gamma-emitting radionuclides. (See Table C-25 [p.C-26].)

No differences were noted between upstream and downstream concentrations of gross alpha, tritium, or cesium-137 in 1999. Although strontium-90 concentrations were not statistically higher at the Felton Bridge location than at the Bigelow Bridge background location, gross beta concentrations were higher at Felton Bridge.

The average weekly gross alpha concentration at Felton Bridge in 1999 was 1.26E-09 μCi/mL (0.05 Bq/L), which is less than 5% of the most conservative alpha DCG; the average weekly gross beta concentration was 4.23E-09 μCi/mL

(0.16 Bq/L), which is less than 1% of the most conservative beta DCG.

Figure 2-3 (*facing page*) shows gross alpha, gross beta, and tritium results over the past thirteen years in Cattaraugus Creek samples taken at Felton Bridge. For the most part, tritium concentrations represent method detection limits and not detected radioactivity. (Method detection limit values are levels below which the analytical measurement could not detect any radioactivity above background. [See Data Reporting in Chapter 1, p.1-4].) Taking into account seasonal fluctuations, gross beta activity appears to have remained constant at this location since 1987.

Drinking Water Sampling Locations. Nine off-site private, residential wells between 1.5 kilometers (0.9 mi) and 7 kilometers (4.3 mi) from the facility were sampled for radiological parameters in 1999. The wells represent the nearest unrestricted use of groundwater near the Project; none draw drinking water from groundwater units underlying the site. A tenth private well, 29 kilometers (18 mi) south of the site, provides a background sample. Sampling locations are shown in Figures A-9 and A-12 (pp.A-11 and A-14) in Appendix A. Results from the sampling are presented in Table C-26 (p.C-27). Radiological results from near-site wells are within the historical range of values measured at the background well.

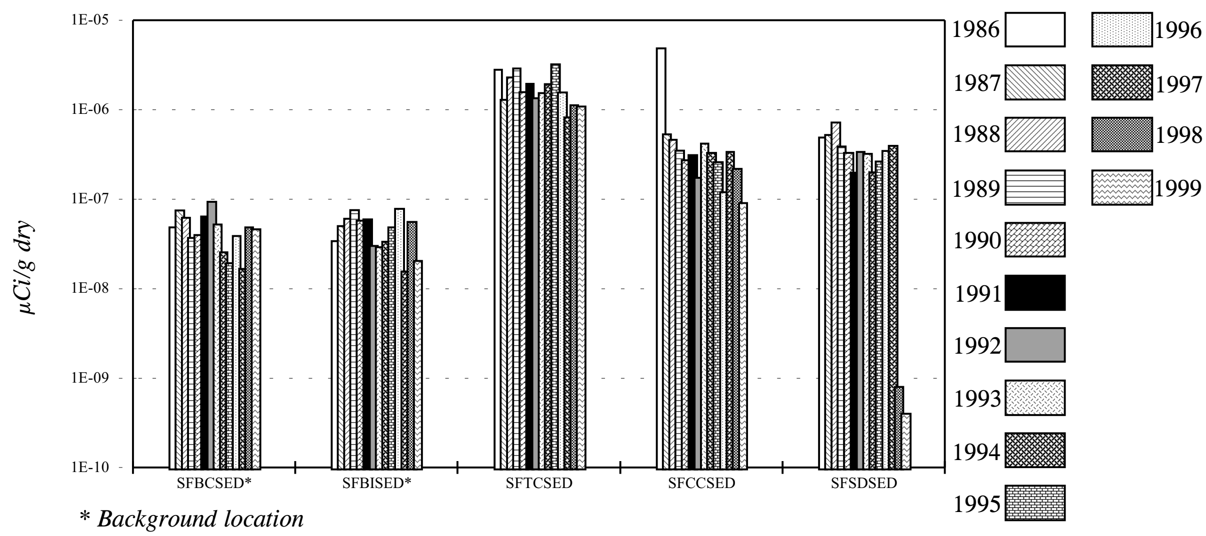
On-site drinking water sources were also monitored for radionuclides at four locations: the Environmental Laboratory (WNDNKEL); the maintenance shop (WNDNKMS); the main plant (WNDNKMP); and the utility room (WNDNKUR). Monthly samples were analyzed for gross alpha, gross beta, and tritium concentrations. Results were consistent with those from the off-site background drinking water well. (See Appendix C, Tables C-15 through C-18 [pp.C-17 through C-20].)

Radiological Monitoring: Sediments

Particulate matter in streams can adsorb radiological constituents in liquid effluents, settle on the bottom of the stream as sediment, and subsequently be eroded or resuspended, especially during periods of high stream flow. These resuspended sediments may provide a pathway for radiological constituents to reach humans either directly via exposure or indirectly through the food pathway.

Sediments are collected on-site at the three points where liquid effluents leaving the site are most likely to be radiologically contaminated: Frank's Creek where it leaves the security fence (SNSP006); the north swamp (SNSW74A); and the northeast swamp (SNSWAMP). Figure A-2 (p.A-4) shows the on-site sediment sampling locations. (Note that swamp sediment samples may be partially composed of soils.) Background samples are also collected at off-site locations upstream of the site. Results from radiological analyses of these samples are listed in Table C-28 (p.C-29). As expected, gross beta, cesium-137, and strontium-90 results were higher at the on-site sediment sampling points than at the off-site background sampling points; gross alpha concentrations were similar to background values.

Sediments are collected off-site at three locations downstream of the WVDP: Buttermilk Creek at Thomas Corners Road (SFTCSED), Cattaraugus Creek at Felton Bridge (SFCCSED), and Cattaraugus Creek at the Springville dam (SFSDSED). The first two sampling points are located at automatic water samplers. The other is in front of the Springville dam, where water would be expected to transport and deposit sediments that had adsorbed radionuclides from the site. Locations upstream of the WVDP are Buttermilk Creek at Fox Valley Road (SFBCSED) and Cattaraugus Creek at Bigelow Bridge



** Background location*

Figure 2-4. Fourteen-year Trends of Cesium-137 in Stream Sediments at Two Locations Upstream and Three Locations Downstream of the WVDP

(SFBISED). The two upstream locations provide background data for comparison with downstream points. Figure A-3 (p.A-5) shows the off-site sediment sampling locations.

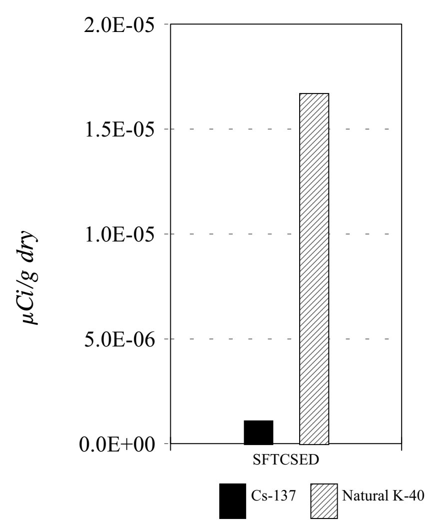


Figure 2-5. Comparison of Cesium-137 with Naturally Occurring Potassium-40 Concentrations in 1999 at Downstream Sampling Location SFTCSED

Although gross alpha, gross beta, and strontium-90 concentrations in sediments downstream of the WVDP are not statistically different from background concentrations, cesium-137 concentrations in downstream sediments historically have been higher. A comparison of annual averaged cesium-137 concentrations from 1986 through 1999 for the five off-site sampling locations is illustrated in Figure 2-4 (*above*). As the figure indicates, cesium-137 concentrations are relatively stable at the two background locations (SFBCSED and SFBISED) and are either stable or declining at the three locations downstream of the WVDP (SFTCSED, SFCCSED, and SFSDSED). As noted in the 1998 Site Environmental Report, the level of cesium-137 observed behind the Springville dam (SFSDSED) was noticeably lower in 1998 than in the past, which may have been associated with the scouring of sediments during a flood on June 26, 1998. In 1999 the concentration of cesium-137 in samples from this same location again were lower than historical values. The cesium-137 concentrations at the two other downstream locations (SFTCSED and SFCCSED) remained near historical levels.

Although cesium-137 activity historically is elevated in downstream Cattaraugus Creek sediments, relative to upstream sediments (see Appendix C, Table C-30 [p.C-31]), the levels are far lower than those of naturally occurring gamma emitters such as potassium-40. (Fig. 2-5 [*facing page*] is a graphic comparison of cesium-137 to potassium-40 at the downstream location nearest the WVDP, i.e., Buttermilk Creek at Thomas Corners Road - SFTCSED.) In addition, these downstream-sediment cesium-137 concentrations are still within the historical range of cesium-137 concentrations in background surface soil (Great Valley [SFGRVAL] and Nashville [SFNASHV]). (See Appendix C, Table C-29 [p.C-30].)

Radiological Monitoring: Air

Permits obtained from the U.S. Environmental Protection Agency (EPA) allow air containing small amounts of radioactivity to be released from plant ventilation stacks during normal operations. The air released must meet criteria specified in the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations to ensure that the environment and the public's health and safety are protected. Dose-based comparisons of WVDP emissions against NESHAP criteria are presented in Chapter 4, Radiological Dose Assessment.

Unlike NESHAP dose criteria, the DOE DCGs are expressed in units of μCi/mL and therefore can be directly compared to concentrations of radionuclides in WVDP air emisssions. DOE standards and DCGs for radionuclides of interest at the WVDP are found in Appendix K, Table K-1 (p.K-3).

Radiological parameters measured in air emissions include concentrations of gross alpha and gross beta, tritium, strontium-90, cesium-137, and other radionuclides. When comparing concentrations with dose limits for screening purposes, gross alpha and beta radioactivities are assumed to come from americium-241 and strontium-90, respectively, because the dose effects for these radionuclides are the most limiting for major particulate emissions at the WVDP.

On-site Ventilation Systems. The exhaust from each EPA-permitted fixed ventilation system on-site is continuously filtered, monitored, and sampled as it is released to the atmosphere. Because concentrations of radionuclides in air emissions are quite low, a large volume of air must be sampled at each point in order to measure the quantity of specific radionuclides released from the facility.

Specially designed sampling nozzles continuously remove a representative portion of the exhaust air, which is then drawn through very fine glass fiber or membrane filters to trap particulates. Sensitive detectors continuously monitor these filters and provide readouts of alpha and beta radioactivity levels.

Separate sampling units on the ventilation stacks of the permitted systems contain another glass fiber filter that is removed every week and tested in the laboratory. These filters are analyzed routinely for the parameters defined in Appendix B of this report.

Special samples also are collected in order to monitor gaseous (non-particulate) emissions of radioactivity. For example, six of the sampling systems contain an activated carbon cartridge that collects gaseous iodine-129, and at two locations water vapor is collected by trapping moisture in silica gel desiccant columns. The trapped water is distilled from the silica gel desiccant and analyzed for tritium. Figure A-4 (p.A-6) shows the locations of on-site air monitoring and sampling points.

The Main Plant Ventilation Stack. The main ventilation stack (ANSTACK) is the primary source of airborne releases at the WVDP. This stack, which vents to the atmosphere at a height of more than 60 meters (more than 200 ft), releases filtered ventilation from several facilities, including the liquid waste treatment system, the analytical laboratories, and off-gas from the vitrification system.

Samples from the main plant stack are collected weekly and analyzed for gross alpha, gross beta, and tritium concentrations. Weekly filters are composited quarterly and analyzed for strontium-90, gamma-emitting radionuclides, total uranium, uranium isotopes, plutonium isotopes, and americium-241. Charcoal cartridges collected weekly are composited quarterly and analyzed for iodine-129. In addition, filters from the main plant ventilation stack are routinely analyzed for strontium-89 and cesium-137 as part of operational-safety monitoring.

Monthly and quarterly total curies released from the main stack in 1999 are summarized in Table D-1 (p.D-3). Total curies released, annual averages, and a comparison of total curies released with the applicable DCGs are summarized in Table D-2 (p.D-4). As in previous years, 1999 results show that average radioactivity levels at the point of discharge from the stack were already below concentration guidelines for airborne radioactivity in an unrestricted environment. Airborne concentrations from the stack to the site boundary are further reduced via dispersion by a factor of about 200,000. Results from air samples taken just outside the site boundary confirm that WVDP operations had no discernible effect on off-site air quality. (See Perimeter and Remote Air Sampling, p.2-16.)

Figure 2-6 (*below*) shows the gross alpha and gross beta curies released per month from the main stack during the past thirteen years. The figure indicates a steady five-year downward trend in both gross alpha and gross beta activity from 1987 to mid-1992 and a stabilization through mid-1995. Pre-vitrification transfers of cesium-loaded zeolite from waste tank 8D-1 to 8D-2 began in late 1995, and releases increased. Since radioactive vitrification operations began in mid-1996 both gross alpha and gross beta

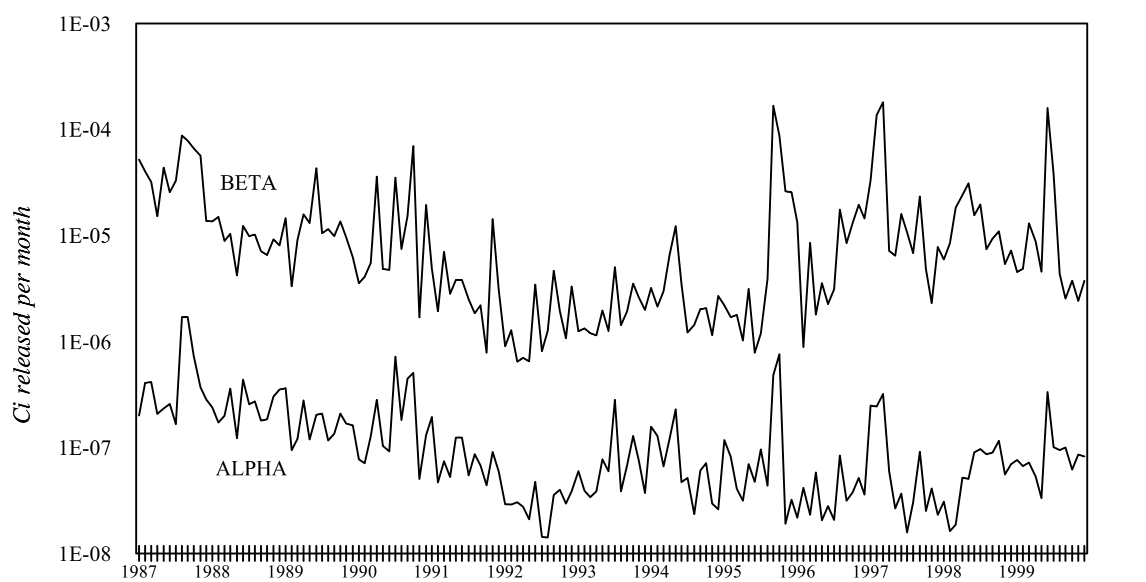


Figure 2-6. Thirteen-year Trends of Gross Alpha and Gross Beta Activity at the Main Stack Sampling Location (ANSTACK)

releases have fluctuated while generally remaining higher than previtrification levels.

In June 1998 the WVDP completed the first phase of high-level waste vitrification, processing the bulk of the waste in tank 8D-2. In the latter part of 1998 the focus of the vitrification program shifted to the second phase, vitrifying waste from the high-level waste residuals in the tank. Phase II vitrification continued throughout 1999. Thirty-five glass canisters were filled during this phase of vitrification.

Concentrations of iodine-129 and tritium released from the main ventilation stack have decreased compared to those observed during the first phase of vitrification. Concentrations of gross alpha, gross beta, cesium-137, and strontium-90 have remained at relatively steady levels since vitrification began.

Vitrification Facility Sampling System. Sampling point ANVITSK and the seismically protected backup sample point ANSEISK monitor emissions from the vitrification heating, ventilation, and air conditioning (HVAC) system. (Off-gas ventilation from the vitrification system itself is released through the main plant stack.)

Radioactivity concentrations were monitored at ANVITSK and ANSEISK before actual radioactive vitrification began in July 1996. The previtrification levels provide a baseline for comparison with concentrations of radionuclides in emissions during vitrification. Results from 1999 are found in Tables D-3 and D-4 (pp.D-5 and D-6).

With the exception of iodine-129, concentrations of radionuclides measured during 1999 were indistinguishable from baseline values. Concentrations of iodine-129 increased marginally during the fourth quarter of 1999, but on an annualized basis these values are indistinguishable from the 1998 data.

Other On-site Air Sampling Systems. Sampling systems similar to those of the main stack monitor airborne effluents from the 01-14 building ventilation stack (ANCSSTK); the contact size-reduction facility ventilation stack (ANCSRFK); the supernatant treatment system ventilation stack (ANSTSTK); and the container sorting and packaging facility ventilation stack (ANCSPFK). (See Fig.A-4 [p.A-6].)

Tables D-5 through D-8 (pp.D-7 through D-10) show monthly totals of gross alpha and beta radioactivity and quarterly total radioactivity released for specific radionuclides at each of these sampling locations. The 1999 samples from ANCSSTK, ANCSRFK, ANSTSTK, and ANCSPFK showed detectable concentrations of gross radioactivity in some cases as well as specific beta- and alpha-emitting radionuclides, but none approached any DOE effluent limitations.

Three other operations are routinely monitored for airborne radioactive releases: the new low-level waste treatment facility ventilation system (ANLLW2V), which came on-line in 1998; the old low-level waste treatment facility ventilation (ANLLWTVH); and the contaminated clothing laundry ventilation system (ANLAUNV).

The old and new low-level waste treatment facility ventilation points and the laundry ventilation system are sampled for gross alpha and gross beta radioactivity. These emission points are not required to be permitted because the potential magnitude of the emissions is so low. Although only semiannual grab sampling is required to verify the low level of emissions, all three points are sampled continuously while discharging to the environment. Data for these three facilities are presented in Tables D-9 through D-11 (pp. D-11 and D-12). Results from 1999 samples were well below DOE effluent limitations.

Permitted portable outdoor ventilation enclosures (OVEs) are used occasionally to provide the ventilation necessary for the safety of personnel working with radioactive materials in areas outside permanently ventilated facilities. Air samples from OVEs are collected continuously while those emission points are discharging, and data from these units are included in annual airborne emission evaluations. (See Table D-15 [p.D-16].) In 1999 average discharges from OVEs were well below DOE guidelines for alpha and beta radioactivity in an unrestricted environment.

Three on-site air samplers collect samples of ambient air in the vicinity of three site waste storage areas—the lag storage area (ANLAGAM), the NDA (ANNDAAM), and the SDA (ANSDAT9). (See Fig.A-4 [p.A-6].) These samplers were put in place to monitor potential diffuse releases of radioactivity. Monitoring data from these locations are presented in Appendix D, Tables D-12 through D-14 (pp. D-13 through D-15). Comparison of radiological data sets for these locations with those at the background air monitoring location AFGRVAL show results that are statistically the same, with the exception of elevated weekly tritium results at ANSDAT9. However, even the highest positive weekly tritium result from ANSDAT9 (5.13E-12μCi/mL [1.90E-04 Bq/L]) was less than 0.005% of the DOE DCG for tritium in air (1E-07μCi/mL).

Perimeter and Remote Air Sampling. Samples for radionuclides in air are collected continuously at six locations around the perimeter of the site and at four remote locations. Maps of perimeter and remote air sampling locations are found on Figure A-5 (p.A-7) and Figure A-12 (p.A-14).

The perimeter locations on Fox Valley Road (AFFXVRD), Rock Springs Road (AFRSPRD), Route 240 (AFRT240), Thomas Corners Road (AFTCORD), Dutch Hill Road (AFBOEHN), and at the site's bulk storage warehouse (AFBLKST) were chosen because they provide historical continuity (as former NFS sampling locations) or because they represent the most likely locations for detecting off-site airborne concentrations of radioactivity.

The remote locations provide data from nearby communities — West Valley (AFWEVAL) and Springville (AFSPRVL) — and from more distant background areas. Concentrations mea-

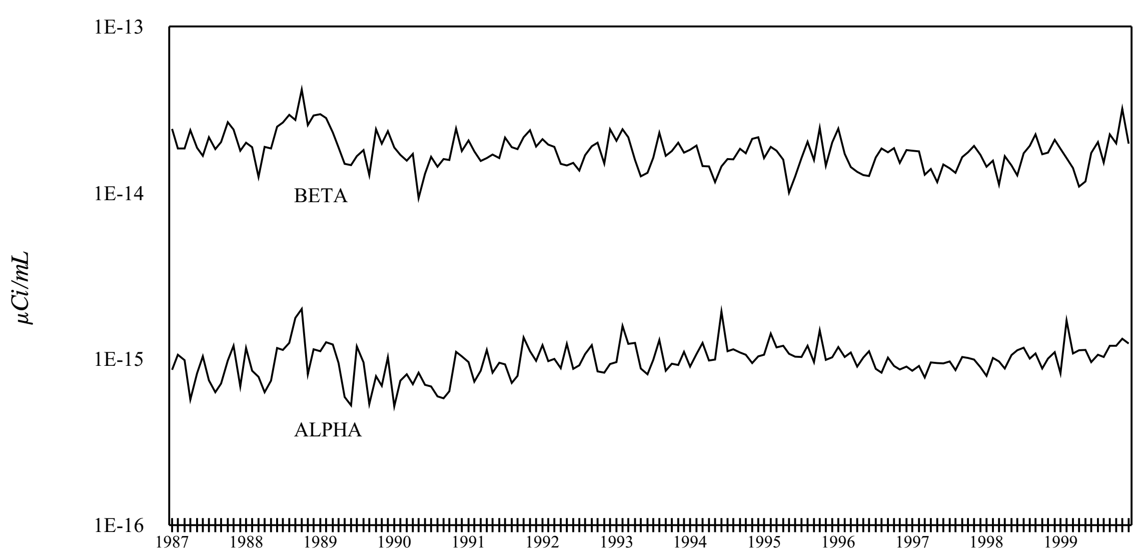


Figure 2-7. Thirteen-year Trends of Gross Alpha and Gross Beta Concentrations at the Rock Springs Road Sampling Location (AFRSPRD)

sured at Great Valley (AFGRVAL, 30.9 km south of the site) and Nashville (AFNASHV, 39.8 km west of the site in the town of Hanover) are considered representative of regional background air.

At all locations airborne particulates are collected on filters for radiological analysis. Samplers maintain an average flow of approximately 40 L/min (1.4 ft^3/min) through a 47-millimeter glass fiber filter. The sampler heads are set above the ground at the height of the average human breathing zone. Filters are collected weekly and analyzed after a seven-day "decay" period to remove interference from short-lived naturally occurring radionuclides. After weekly sample filters are measured for gross alpha and gross beta concentrations, they are combined in a quarterly composite consisting of thirteen weekly filters. The composite is analyzed for specific alpha-emitting, beta-emitting, and gamma-emitting radionuclides.

At two locations, the nearest perimeter location in the predominant downwind direction (Rock Springs Road) and the farthest background location (Great Valley), desiccant columns are used to collect airborne moisture for tritium analysis and charcoal cartridges are used to collect samples for iodine-129 analysis.

Trends of gross alpha and gross beta concentrations at the Rock Springs Road location are shown in Figure 2-7 (p. 2-16). Within a range of seasonal and weekly fluctuations, the concentrations have been relatively constant over the past thirteen years.

The gross alpha and gross beta ranges and annual averages for each of the off-site sampling points are noted on Tables 2-3 and 2-4 (p.2-18). All gross alpha averages were below detection levels. Gross beta results from samples taken at two near-site communities and from the site perimeter were similar to those from the background samplers, suggesting that there is no adverse site influence on the air quality at these near-site locations. Gross beta concentrations at all off-site and perimeter locations averaged about 1.99E-14 μCi/mL, which is about 0.2% of the DCG for strontium-90 in air (9E-12 μCi/mL). The highest average gross beta concentration (2.25E-14 μCi/mL) was at Thomas Corners Road. This represents less than 0.3% of the DCG. Additional radionuclide data from these samplers are provided in Tables D-16 through D-25 (pp. D-17 to D-26).

Although low levels of tritium, strontium-90, iodine-129, and cesium-137 were detected in emissions from the main stack on-site, average results for these radionuclides at near-site locations were indistinguishable from background values, confirming that site releases have a negligible effect on near-site air quality.

Fallout Pot Sampling. Short-term global fallout is sampled for radionuclide concentrations each month at four of the perimeter air sampler locations and at one on-site location near the rain gauge outside the Environmental Laboratory. (See Figs.A-4 and A-5 [pp.A-6 and A-7].) Monthly gross alpha, gross beta, potassium-40, and cesium-137 results are reported in nCi/m^2 and tritium results are reported in μCi/mL. The 1999 results from on-site and perimeter locations are similar to each other and are within the ranges noted in previous years. The small levels of tritium and cesium-137 detected in main stack emissions did not measurably affect on-site or perimeter fallout pot samples in 1999. The 1999 data from these analyses and the pH in precipitation are summarized in Tables D-26 through D-30 (pp.D-27 through D-29).

Off-Site Surface Soil Sampling. In order to assess long-term fallout deposition, surface soil near the off-site air samplers is collected annually and analyzed for radioactivity. Samples were collected in 1999 from ten locations: six near-site points on the perimeter of the

Table 2-3
1999 Gross Alpha Concentrations at Off-site, Perimeter, and On-site Ambient Air Sampling Locations

Location	No. of Samples	Range		Annual Average	
		(µCi/mL)	*(Bq/m³)*	*(µCi/mL)*	*(Bq/m³)*
AFBLKST	53	<6.07E-16 — 2.01E-15	<2.25E-05 — 7.44E-05	0.77±1.16E-15	2.85±4.28E-05
AFBOEHN	53	<7.46E-16 — 3.17E-15	<2.76E-05 — 1.17E-04	0.86±1.20E-15	3.19±4.43E-05
AFFXVRD	53	<7.52E-16 — 2.05E-15	<2.78E-05 — 7.58E-05	0.79±1.12E-15	2.92±4.14E-05
AFGRVAL	53	<7.62E-16 — 2.10E-15	<2.82E-05 — 7.78E-05	0.73±1.12E-15	2.68±4.13E-05
AFNASHV	53	<8.20E-16 — 2.22E-15	<3.03E-05 — 8.22E-05	0.80±1.14E-15	2.95±4.23E-05
AFRSPRD	53	<5.49E-16 — 2.86E-15	<2.03E-05 — 1.06E-04	0.67±1.11E-15	2.48±4.12E-05
AFRT240	53	<7.84E-16 — 2.37E-15	<2.90E-05 — 8.75E-05	0.81±1.18E-15	2.99±4.35E-05
AFSPRVL	53	<7.90E-16 — 2.20E-15	<2.92E-05 — 8.15E-05	0.79±1.14E-15	2.93±4.23E-05
AFTCORD	53	<6.84E-16 — 2.29E-15	<2.53E-05 — 8.47E-05	0.90±1.20E-15	3.32±4.43E-05
AFWEVAL	53	<8.02E-16 — 2.45E-15	<2.97E-05 — 9.07E-05	0.88±1.19E-15	3.25±4.41E-05
ANLAGAM	51	<5.64E-16 — 4.85E-15	<2.09E-05 — 1.80E-04	0.91±1.12E-15	3.37±4.15E-05
ANNDAAM	53	<5.77E-16 — 2.76E-15	<2.13E-05 — 1.02E-04	8.46±9.12E-16	3.13±3.38E-05

Table 2-4
1999 Gross Beta Concentrations at Off-site, Perimeter, and On-site Ambient Air Sampling Locations

Location	No. of Samples	Range		Annual Average	
		(µCi/mL)	*(Bq/m³)*	*(µCi/mL)*	*(Bq/m³)*
AFBLKST	53	8.64E-15 — 4.67E-14	3.20E-04 — 1.73E-03	1.96±0.35E-14	7.27±1.28E-04
AFBOEHN	53	1.05E-14 — 5.08E-14	3.88E-04 — 1.88E-03	2.12±0.36E-14	7.85±1.32E-04
AFFXVRD	53	8.56E-15 — 4.48E-14	3.17E-04 — 1.66E-03	2.04±0.34E-14	7.54±1.26E-04
AFGRVAL	53	8.94E-15 — 3.73E-14	3.31E-04 — 1.38E-03	1.86±0.33E-14	6.90±1.23E-04
AFNASHV	53	9.65E-15 — 5.34E-14	3.57E-04 — 1.98E-03	2.00±0.34E-14	7.40±1.27E-04
AFRSPRD	53	9.06E-15 — 4.80E-14	3.35E-04 — 1.78E-03	1.81±0.33E-14	6.70±1.22E-04
AFRT240	53	1.12E-14 — 4.94E-14	4.14E-04 — 1.83E-03	2.01±0.35E-14	7.43±1.29E-04
AFSPRVL	53	7.88E-15 — 4.40E-14	2.92E-04 — 1.63E-03	1.92±0.34E-14	7.10±1.25E-04
AFTCORD	53	9.58E-15 — 6.26E-14	3.55E-04 — 2.32E-03	2.25±0.37E-14	8.32±1.35E-04
AFWEVAL	53	1.05E-14 — 4.81E-14	3.90E-04 — 1.78E-03	1.96±0.35E-14	7.26±1.28E-04
ANLAGAM	51	9.12E-15 — 4.09E-14	3.37E-04 — 1.51E-03	1.92±0.32E-14	7.11±1.17E-04
ANNDAAM	53	5.95E-15 — 4.30E-14	2.20E-04 — 1.59E-03	1.82±0.27E-14	6.75±1.01E-04

WNYNSC, two in nearby communities, and two in locations 30 to 40 kilometers distant from the Project. Maps of the off-site surface soil sampling locations are on Figures A-3 and A-12 (pp.A-5 and A-14).

Concentrations of gross alpha and beta radioactivity, strontium-90, cesium-137, plutonium-239/240, and americium-241 were determined at all ten locations; concentrations of uranium radionuclides and total uranium were determined at two perimeter locations and one background location.

The measured concentrations of site-related radionuclides in soils from the perimeter and community locations (Table C-29 [p.C-30]) were statistically indistinguishable from normal regional background concentrations. However, cesium-137 concentrations from the Rock Springs Road location — northwest of the site — remained marginally higher than background concentrations. Soils collected near the Rock Springs Road air sampler have consistently shown higher than background cesium-137 concentrations.

Radiological Monitoring: Food Chain

Each year food and forage samples are collected from locations near the site (Fig. A-9 [p.A-11]) and from remote locations (Fig.A-12 [p.A-14] in Appendix A). Fish and deer are collected during periods when they would normally be taken by sportsmen for consumption. Most milk samples are collected monthly; beef is collected semiannually. Hay, corn, apples, and beans are collected at the time of harvest.

Fish. Fish are obtained under a collector's permit by electrofishing, a method that temporarily stuns the fish, allowing them to be netted for collection. Electrofishing allows a more species-selective control than sport fishing, with unwanted fish being returned to the creek essentially unharmed.

Fish are collected from three locations in Cattaraugus Creek: Two locations are downstream of WNYNSC drainage — one above the Springville dam (BFFCATC) and one below the Springville dam (BFFCATD) — and one location is upstream of the site (BFFCTRL). (See Fig.A-12, p.A-14.)

Twenty fish samples were collected in 1999 (ten the first half of the year and ten the second half of the year) immediately downstream (above the Springville dam at BFFCATC), and another twenty were collected from the control location upstream of the site (BFFCTRL). Ten fish samples were collected from Cattaraugus Creek below the dam (BFFCATD), including species that migrate more than 60 kilometers (nearly 40 mi) upstream from Lake Erie. These specimens are representative of sport fishing catches in the creek downstream of the Springville dam.

The edible portion of each fish was analyzed for strontium-90 content and the gamma-emitting radionuclide cesium-137. (See Table F-4 [pp. F-6 through F-8] in Appendix F for a summary of the results.) No statistically significant differences were found in strontium-90 or cesium-137 concentrations between fish collected upstream of the site and fish collected downstream of the site.

Venison. Venison from vehicle-deer accidents around the WNYNSC was analyzed for tritium, potassium-40, strontium-90, and cesium-137 concentrations, as was venison from deer collected far from the site in the towns of Bolivar, Arkwright, and Portville, New York. (See Figs.A-9 and A-12 [pp.A-11 and A-14].) Results from these samples are shown in Table F-2 (p.F-4) in Appendix F.

Electrofishing in Cattaraugus Creek

Low levels of radioactivity from cesium-137, strontium-90, and naturally occurring potassium-40 were detected in both near-site and control samples. Although results vary from year to year, data from the last nine years show no statistical differences between radionuclide concentrations in near-site and control samples.

For the sixth year, during the large-game hunting season, hunters were allowed access to the WNYNSC, excluding the WVDP premises, in a controlled hunting program established by NYSERDA. Historically, concentrations of radioactivity in deer flesh have been very low and Project activities have been shown to have little or no effect on the local herd.

Beef. Beef samples are taken semiannually from both near-site and remote locations (Figs.A-9 and A-12 [pp.A-11 and A-14] in Appendix A). As with venison samples, beef samples are analyzed for tritium, potassium-40, strontium-90, and cesium-137. Results are presented in Table F-2 (p.F-4) in Appendix F. No significant differences were found between results from near-site and background samples.

Milk. Monthly milk samples were taken in 1999 from dairy farms near the site to the north and west — downwind in the prevailing wind direction from the WVDP — and from control farms more than 25 kilometers from the site. Annual milk samples were collected at two near-site farms to the south and east of the site. For locations of near-site and remote sampling points, see Figure A-9 (p.A-11) and Figure A-12 (p.A-14) in Appendix A.

Monthly samples from each location were composited into single quarterly samples for analysis. Quarterly composites and annual samples were analyzed for tritium, potassium-40, strontium-90, iodine-129, and cesium-137. Results are presented in Table F-1 (p.F-3) in Appendix F. Near-site sample results were indistinguishable from background control sample results.

Vegetables, Fruit, and Forage. Sweet corn, beans, apples, and hay were collected at near-site and background locations at harvest time. Sampling locations are shown on Figures A-9 (p.A-11) and A-12 (p.A-14) in Appendix A. Samples were analyzed for tritium, potassium-

40, cobalt-60, strontium-90, and cesium-137. Results are presented in Table F-3 (p.F-5) in Appendix F.

No tritium, cobalt-60, or cesium-137 were found in any of the near-site samples; positive strontium-90 results were noted in all but one sample, a background corn sample. Strontium-90 was higher in near-site corn and hay than in background corn and hay. However, strontium-90 concentrations were higher in background beans than in near-site beans. All results were within the ranges noted in previous years.

Direct Environmental Radiation Monitoring

This was the sixteenth full year in which direct penetrating radiation was monitored at the WVDP. Thermoluminescent dosimeters (TLDs) are placed at each monitoring location for one calendar quarter (three months) and are then processed to obtain the integrated gamma radiation exposure at that location.

Monitoring points are located on-site at the waste management units, at the site security fence, around the WNYNSC perimeter and the access road, and at background locations remote from the WVDP (Figs.A-10, A-11, and A-12 [pp.A-12, A-13, and A-14]). The identification numbers associated with each location were assigned in chronological order of original installation. (See TLD Locations and Identification Numbers below.)

Quarterly and annual averages of TLD measurements at off-site and on-site locations are noted in Appendix H, Tables H-1 and H-2 (pp.H-3 and H-4). The results from 1999 mea-

TLD Locations and Identification Numbers

Perimeter of the WNYNSC	1-16, 20
Perimeter of the WVDP security fence	24, 26-34
On-site sources or waste management units *(Note: some TLDs monitor more than one waste management unit)*	18, 32-36, 43 (drum cell) 18, 19, 33, 42, 43 (SDA) 24 (component storage, near WVDP security fence) 25 (maximum measured exposure rate at the closest point of public access) 38 (main plant and, in previous years, the cement solidification system) 39 (parking lot security fence closest to the vitrification facility) 40 (high-level waste tank farm)
Near-site communities	21 (Springville) 22 (West Valley)
Background	17 (Five Points Landfill in Mansfield) 23 (Great Valley) 37 (Nashville) 41 (Sardinia)

surements show typical seasonal variations and are similar to results from previous years.

On-Site Radiation Monitoring. Table H-2 (p.H-4) shows the average quarterly exposure rate at each on-site TLD. The on-site monitoring point with the highest dose readings was location #24. Sealed containers of radioactive components and debris from the plant decontamination work are stored nearby. The storage area is well within the WNYNSC boundary, just inside the WVDP fenced area, and is not accessible by the public.

The average exposure rate at location #24 was about 591 milliroentgens (mR) per quarter (0.27 mR/hr) during 1999, which is almost identical to the exposure rate noted at this location in 1998 (0.32 mR/hr). Exposure rates at this location are gradually decreasing because the radioactivity in the materials stored nearby is decaying. (See Fig. 1-1 [p.1-9] in Chapter 1.)

The average 1999 dose rate at locations around the integrated radwaste treatment storage building — the drum cell — including TLDs #18, #32, #34, #35, #36, and #43 was 0.02 mR/hr, about the same as in 1998. Exposure rates around the drum cell are above background levels because the building contains drums filled with decontaminated supernatant mixed with cement. (See also Fig. 1-2 [p.1-10] in Chapter 1.) The drum cell and the surrounding TLD locations are well within the WNYNSC boundary and are not accessible by the public.

Results from TLD #42, near a waste tank that stores SDA leachate, are also above background. However, results from on-site TLDs farther away from radioactive waste storage areas approach background levels. For example, results from location #27 (near Frank's Creek northeast of the NDA, SDA, and drum cell), and #28 and #31 (near Rock Springs Road west of the drum cell at the security fence) are statistically indistinguishable from background exposure rates.

Perimeter and Off-Site Radiation Monitoring. Table H-1 (p.H-3) lists the average quarterly exposure rate at each off-site TLD location. The perimeter TLDs (TLDs #1-16 and #20) are

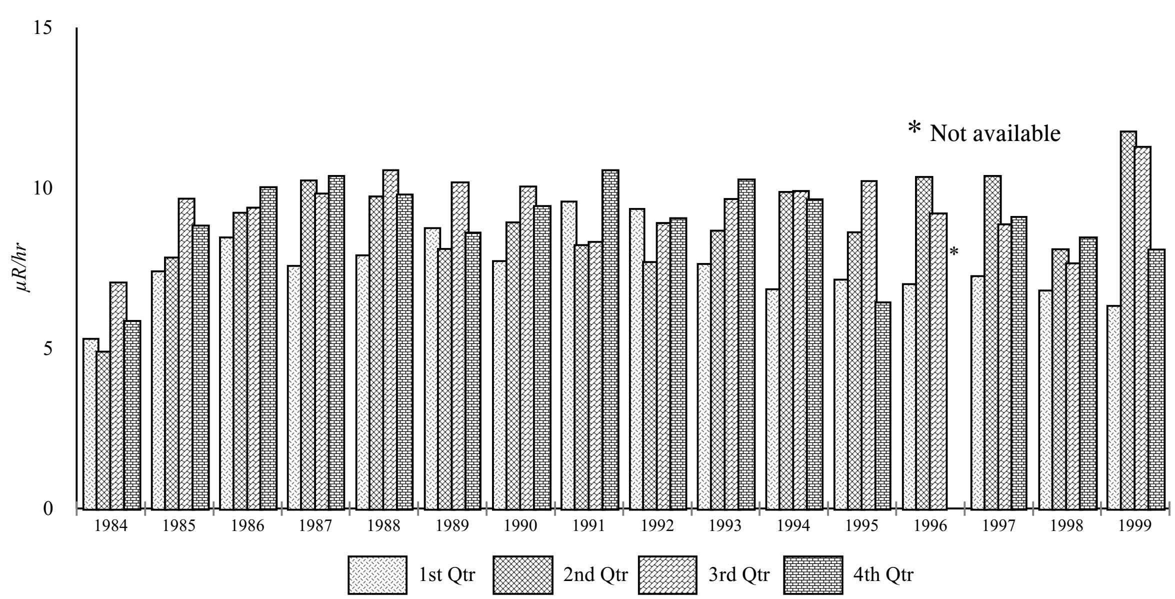


Figure 2-8. Sixteen-year Trend of Environmental Radiation Levels at Perimeter TLDs

located in the sixteen compass sectors around the facility near the WNYNSC boundary. Results from the background and community TLDs were essentially the same as results from the perimeter TLDs. The perimeter TLD quarterly averages since 1985 (expressed in microroentgen per hour [μR/hr]), shown on Figure 2-8 (*facing page*) indicate seasonal fluctuations but no long-term trends. The quarterly average of the seventeen WNYNSC-perimeter TLDs was 20.9 mR per quarter (9.5 μR/hr) in 1999, slightly higher than in 1998.

Confirmation of Results. The performance of the environmental TLDs is confirmed periodically using a portable high-pressure ion chamber (HPIC) detection system. In the third quarter of 1999 the HPIC was taken to each of the forty-three environmental TLD locations and instantaneous dose readings (in μR/hr) were obtained. These readings are listed with the comparable third-quarter environmental TLD results in Table H-3 (p.H-5). The TLD results include the entire third quarter of 1999; the HPIC results were collected over a period of less than 30 minutes. Since the measurements are made with different systems and over differing periods of time, they are not directly comparable. Even so, the relative percent difference between the two sets of measurements was less than 12%, indicating good agreement between these two different measurement methods. (Guidance in ANSI N545-1975, the standard for environmental dosimetry, uses less than 30% total uncertainty as a performance specification for TLD measurements.)

Meteorological Monitoring

Meteorological monitoring at the WVDP provides representative and verifiable data that characterize the local and regional climatology of the site. These data are used primarily to assess potential effects of routine and nonroutine releases of airborne radioactive materials and to develop dispersion models used to calculate the effective dose equivalent to off-site residents.

Since dispersive capabilities of the atmosphere are dependent upon wind speed, wind direction, and atmospheric stability (which is a function of the difference in temperature between two elevations), these parameters are closely monitored and are available to the emergency response organization at the WVDP.

The on-site 60-meter meteorological tower (Fig. A-1 [p.A-3]) continuously monitors wind speed and wind direction. Temperatures are measured at both 60-meter and 10-meter elevations. In addition, an independent, remote 10-meter meteorological station located approximately 8 kilometers south of the site on a hillcrest on Dutch Hill Road continuously monitors wind speed and wind direction. (See Fig.A-12 [p.A-14].) Dewpoint, precipitation, and barometric pressure are also monitored on-site.

The two meteorological locations supply data to the primary digital and analog data acquisition systems located within the Environmental Laboratory. On-site systems are provided with either uninterruptible or standby power backup in case of site power failures. In 1999 the on-site system data recovery rate (time valid data were logged versus total elapsed time) was approximately 95.7%. Regional data at the 10-meter elevation are shown on Figure I-1 (p.I-3). Figures I-2 and I-3 (pp. I-4 and I-5) illustrate 1999 mean wind speed and wind direction at the 10-meter and 60-meter elevations on the on-site tower.

Weekly and cumulative total precipitation data are illustrated in Figures I-4 and I-5 (p.I-6) in Appendix I. Precipitation in 1999 was approximately 78.7 centimeters (31 in), about 24% below the annual average of 104 centimeters (41 in).

Documentation such as meteorological system calibration records, site log books, and analog strip charts are stored in protected archives. Electronic files containing meteorological data are copied (downloaded) weekly and stored off-site. Meteorological towers and instruments are examined three times per week for proper function and are calibrated semiannually and/or whenever instrument maintenance might affect calibration.

The meteorological system was evaluated in 1998 and equipment and software upgraded in 1999 to ensure year-2000 compliance.

Checking Data from the Meteorological Tower

Special Monitoring

Special monitoring comprises sampling and analyses not covered by the routine environmental monitoring program but that address items of environmental interest. Special monitoring programs are used to verify and/or track these items.

Iodine Emissions from the Main Stack. When radioactive vitrification operations began in 1996, emission rates of radioactive isotopes of iodine increased at the main stack. The increase occurred because gaseous iodine is not as efficiently removed by the vitrification process off-gas treatment system as are most other radionuclides.

Iodine-129 is a long-lived radionuclide that has always been present in main stack emissions, and in 1996 iodine-131 also was detected. Iodine-131, an isotope with a half-life of eight days, originates from the decay of curium-244, which is present in the high-level waste. Iodine-131 gas was not detectable until vitrification began because the previtrification storage and management of high-level waste had prevented detectable levels of iodine-131 from reaching the air effluent. In the process of preparing the high-level waste for vitrification, the quantities of iodine-129 increased compared to previtrification levels and a very small — yet detectable — quantity of iodine-131 was released.

Iodine-129 was monitored closely during 1999 and the results compared to the operation of the vitrification facility. Weekly iodine-129 concentrations were within the range of values observed since vitrification began. In 1999 the total quantity of iodine-129 decreased slightly from the 1998 total. (See Table D-1 [p.D-3].)

(For more information on the off-site effective dose from airborne emissions see Predicted Dose from Airborne Emissions [p.4-8] in Chapter 4.)

Mercury at the Low-level Waste Treatment Facility. Increasing concentrations of total mercury were observed in 1999 in process water collected in the low-level waste treatment facility. The source of the mercury was determined to be process water from the liquid waste treatment system evaporator. (The evaporator is used to separate liquids from solid residuals generated during processing of high-level radioactive waste.) Negotiations with NYSDEC regarding additional SPDES permit monitoring requirements and limits were initiated in 1999. In addition, special sampling and analysis methods for very low levels of mercury are being evaluated. It is expected that a final SPDES permit that addresses mercury will be issued in 2000.

Nonradiological Monitoring: Surface Water

Liquid discharges are regulated under the State Pollutant Discharge Elimination System (SPDES). The WVDP holds a SPDES permit that identifies the outfalls where liquid effluents are released to Erdman Brook (Fig.A-2 [p.A-4]) and specifies the sampling and analytical requirements for each outfall. The current SPDES permit (effective June 1995) was administratively renewed without changes by NYSDEC and was issued to the WVDP in September 1998 with an effective date of February 1, 1999 and an expiration date of February 1, 2004. The conditions and requirements of the SPDES permit are summarized in Table G-1 (pp.G-3 and G-4) in Appendix G.

The permit identifies four outfalls:

- outfall WNSP001, discharge from the low-level waste treatment facility

- outfall WNSP007, discharge from the sanitary and industrial wastewater treatment facility

- outfall WNSP008, groundwater effluent from the perimeter of the low-level waste treatment facility storage lagoons

- outfall 116, a sampling location in Frank's Creek that represents the confluence of outfalls WNSP001, WNSP007, and WNSP008 as well as storm water runoff, groundwater surface seepage, and augmentation water. Samples from upstream sources (WNSP001, WNSP007, and WNSP008) are used to calculate total dissolved solids at this location and to demonstrate compliance with the SPDES permit limit for this parameter. (Outfall 116 is referred to as a "pseudo-monitoring" point on the SPDES permit. [See the Glossary, p.7.])

Some of the more significant features of the SPDES permit are the requirements to report five-day biochemical oxygen demand (BOD_5), total dissolved solids, iron, and ammonia data as flow-weighted concentrations and to apply a net discharge limit for iron. The net limit allows the Project to account for the iron that is naturally present in the site's incoming water. The flow-weighted limits apply to the flow-proportioned sum of the Project effluents.

The SPDES monitoring data for 1999 are displayed in Tables G-3A through G-8 (pp.G-5 through G-15). The WVDP reported no permit exceedances in 1999. (See also the Environmental Compliance Summary: Calendar Year 1999, SPDES-permitted Outfalls [pp. ECS-9 through ECS-10]).

Semiannual grab samples at locations WNSP006 (Frank's Creek at the security fence), WNSWAMP (northeast swamp drainage), WNSW74A (north swamp drainage), and WFBCBKG (Buttermilk Creek at Fox Valley) were taken in 1999. These samples are screened for organic constituents and selected anions, cations, and metals. Results of these measurements for all of these locations are found in Table C-27 (p.C-28).

Nonradiological Monitoring: Drinking Water

Site drinking water is monitored to verify compliance with EPA and NYSDOH regulations. (See Safe Drinking Water Act [p.ECS-12] in the Environmental Compliance Summary: Calendar Year 1999.) Samples are collected annually and analyzed for nitrate, fluoride, and metals concentrations. Sampling and analysis for copper and lead are conducted according to Cattaraugus County Health Department guidance. The 1999 monitoring results indicated that the Project's drinking water met NYSDOH, EPA, and Cattaraugus County Health Department drinking water quality standards.

Nonradiological Monitoring: Air

Nonradiological air emissions and plant effluents are permitted under NYSDEC and EPA regulations. (The regulations that apply to the WVDP are listed in Table K-2 [p.K-4] in Appendix K. The individual air permits [certificates to operate] held by the WVDP are identified and described in Table K-3 [pp.K-5 and K-6].) The nonradiological air permits are for emissions of regulated pollutants that include particulates, ammonia, and nitric acid mist. Emissions of oxides of nitrogen and sulfur are each limited to 100 tons per year and are reported to NYSDEC every quarter. Nitrogen oxides emissions for 1999 were approximately 7 tons; sulfur dioxide emissions were approximately 0.13 tons.

Although monitoring of these parameters currently is not required, the WVDP has developed an opacity observation program: If nitrogen oxides (NO_x) are emitted at sufficient concentrations, the air discharged from the main stack will take on a yellow-brown color. The intensity of this color (opacity) is in proportion to NO_x concentration. In order to be capable of assessing and documenting such potential emissions, selected staff environmental scientists and engineers completed a New York State-certified opacity observation training course.